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Application of Peak-end rule in research of product use

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Nowadays, products are supposed to meet the users' needs, including their emotions and experience. Evoking positive emotions will be an important design goal. This study is based on the Jordan's experiment (1998) which arranged that participants recalled the pleasures with product in the interviews. However, the more we want to know is all the emotional changes in using a product and why users recall it pleasantly. This research applies the peak-end rule to assess the user's emotions in a product use process. This study is expected to (1) explore the feasibility of the peak-end rule applied to the product use process;(2) establish a theoretical framework that can effectively finding the peak and end points of emotions that following researchers can apply it to product design. It's a good start to apply peak-end rule to directly and efficiently gain insights and emotions from participants.

Keywords: peak-end rule, user experience, pleasure with products

1 Introduction

The trend in product design has undergone several changes. It started from production-oriented, marketing-oriented in the past to user-centred nowadays. Based on user-centred design, products are supposed to meet the user's needs, and change the design targets from the aims on usability to the users' emotion and experience. From the three levels (visceral level, behavioural level and reflective level) of the book *emotional design* authored by Donald A. Norman, the product can arouse users' positive feelings in the three aspects of intuitive attraction, ease of use and meaning of products. All of them can cause users to feel the appeal of the products and create pleasure, which will prompt users to feel better when using products (Norman, 2004). Furthermore, hedonic consumerism refers users' emotions and experience to the multi-sensory image, fantasy and emotional arousal experience that users pay attention to when using products (Hirschman & Holbrook, 1982).

Human beings seek happiness in the lifetime, and we are also constantly seeking pleasure in the daily life. Meanwhile, people unavoidably interact with miscellaneous products every day. Therefore, if the product can provide pleasant emotions for users, pleasure can meet people's need and desire. Jordan (1997) proposes the four pleasures in product use, quoting the anthropologist Lionel Tiger's four kinds of pleasures. According to Jordan's definition of pleasurable products, it should be based on ease of use, and provide functional advantages and the benefits of pleasure and enjoyment(Jordan, 1997).

This study is based on the Jordan's experiment (1998), which arranged participants recalled of the product's pleasure. We arrange every participant use a product and assess the using process. This study is conducted with thinking aloud protocols that can efficiently gain insights into participants' thought in the experiment. In addition, we apply the peak-end rule to assess collected thoughts and emotions after the experiment. The peak-end rule suggests that people's feelings in recalling events will be affected by the peak and end of the emotion. (Kahneman, Fredrickson, Schreiber, & Redelmeier,1993).

This study intends to uncover the user's emotions in the product use and applies the peak-end rule to conduct qualitative interviews and evaluations. To discuss the user's pleasure, the assessment after the experiments will verify that the user's emotions are related to the peak-end rule. Results are expected to be applied to the future design of the products and establish the framework of the product design or usability testing. It provides a model that researchers can effectively apply to the product development in the future. In summary, there are two research goals as below:

(1) Exploring the feasibility of the peak-end rule applied to assess a user's emotions in product use process, effectively distinguishing the emotional points of a user in each step of product use and evaluating the extreme peak-end points of the emotion.

(2) Providing a theoretical framework for assessing the user's emotions in product use process and a model for effectively finding the extremes of emotions that allows follow-up researchers to apply this framework for product design and development.

2 Review of the Literature

2.1 Pleasures in the product use

The four pleasures mentioned by the anthropologist Lionel Tiger in the book *The Pursuit of Pleasure* include: physical, social, psychological and ideological(Tiger, 1992). Then, Jordan define the four pleasures in the product use(Jordan, 2003).

- Physio-pleasure: The physiological pleasure comes from human's senses, which can be connected to touch, taste, smell, etc.
- Socio-pleasure: The social pleasure comes from interacting with others, and products can promote interpersonal interaction in different ways.
- Psycho-pleasure: The psychological pleasure is related to human cognition and emotional response. In terms of products, people may have cognitive demands and emotional reactions to products.
- Ideo-pleasure: The ideo-pleasure is connected to human values. In the context of products, it refers to the aesthetics of products and the value embodied in products.

2.2 Peak-end Rule

The peak-end rule is a popular practice when talking about user experience. The theory of peak-end rule suggests that a person's feeling in recalling an event will be affected by the peak and end of emotion (Fig.1).

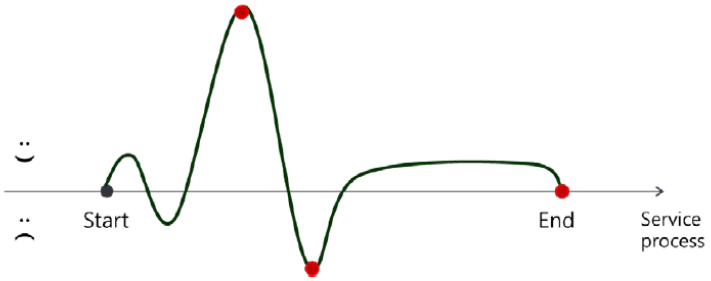

Figure 1. The peak-End Rule (Chen, 2016)

Kahneman et al. (1993) conduct experiments that patients undergoing diagnostic colonoscopy. Two groups of participants suffer from colonoscopy and reach to same level of pain. However, there is a big difference between the two groups' ending experience. The patients of group A suffer a process of pain and stop in the extreme pain. Group B suffer from a longer process but feel less painful in the end (Fig.2). Finally, the research points out that the participants' retrospective evaluations are affected by the peak and end ratings. The group of patient A recognize the colonoscopy as worse experience. This result shows people's memory is influenced by the end moments of experience(Kahneman, 2011). Although the group of patient B undergo longer process and reach to the same level of pain as well. The reaction of emotions is contrary to objective facts(Do, Rupert, & Wolford, 2008). In the same way, the study also points out that people think the life which ends in the perfection is better than the life with additional few years which are not so happy as before(Diener, Wirtz, & Oishi, 2001).

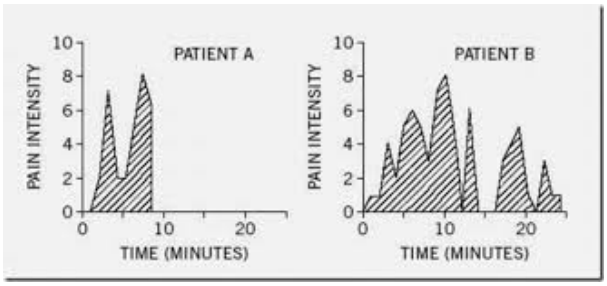

Figure 2. Colonoscopy experiment (Kahneman et al., 1993)

2.3 Thinking aloud protocol

Thinking aloud protocol is a method that requires participants to speak aloud while solving a problem or working in a task. This protocol is widely used in usability testing, which acquire the context of building computer systems (Jaspers, Steen, van den Bos, & Geenen, 2004). The think aloud protocol is a method to efficiently gain insight in the human's thoughts when solving problems. It produces qualitative data and insights in user's thoughts and emotions that can provide a wide knowledge for researchers to get deep understanding of users (Mack, Lewis, & Carroll, 1983).

Usually, participants are asked to verbalize their thoughts when they worked in the task and describe what questions come into their mind. They are encouraged to speak aloud the plans, inferences, knowledge or what they are aware of currently(Mack, Lewis, & Carroll, 1983). The comments from participants are tape-recorded or video-recorded and prepared for later analysis.

3 Methods

We select participants who have low involvement in the coffee machine through the pre-test interviews (Fig.3). In the experiment, the participants are asked to use coffee machine step by step. After, the participants recall their memory and convert their emotions to scores from 1 to 10 in a diagram. The scores are turned into an emotional curve in the end. This study analyses the emotional curve and understand whether the experimental results are related to the peak-end rule. This study chooses Nescafe® dolce Gusto® Mini Me as an experimental product. This product which won the red dot award in 2014, includes the four pleasures of the product defined by Jordon (2003). In addition, it also includes a series of operation steps. And we choose unsweetened latte macchiato to do experiments because it can cover all the steps and its flavour is neutral which avoid affecting participants' emotions.

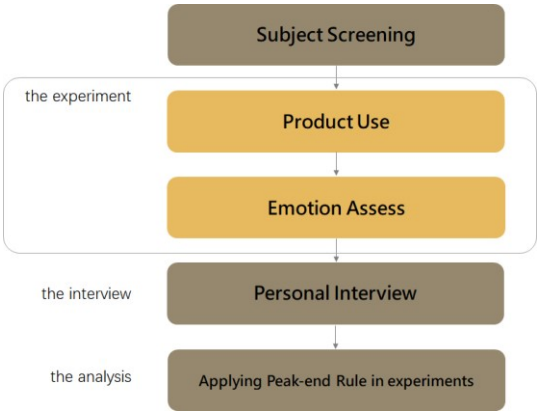

Figure 3. The research process of this study

3.1 Participants

There were 6 participants in the experiment, aged from 22 to 26. In the subject selecting step, each participant was interviewed one to one. We chose participants who drinks 1-3 times a week which are classified as light users(Bhumiratana, Adhikari, & Chambers, 2014) that we can focus on the using experience. All of them have experience using two kinds of coffee machines, but they are not familiar with the capsule coffee machine. Thus, they have more objective feelings in the product use process. The participants were asked questions about the habits, frequencies and reasons of using coffee machine (see as Table 1).

Table 1 Participant's personal data

Subject	Age	Gender	Frequency	Reasons of using coffee machine
1	25	Female	1-3 times a week	Efficient Easy to use
2	25	Male	1-3 times a week	Efficient
3	26	Male	1-3 times a week	Good taste Cheap
4	25	Male	1-3 times a week	Good taste Easy to use
5	23	Male	1-3 times a week	Efficient Good taste
6	22	Female	1-3 times a week	Efficient Cheap

3.2 Experiment Design

In the beginning of the experiment, the participants were asked to see a video which shows how to use capsule coffee machine, and they should follow the process step by step. During the experiment, participants are encouraged to say the thoughts or feelings in the brewing process and all their using processes are recorded. After using the coffee machine, participants are asked to recall and evaluate the emotions in using steps. They have to give scores from 1 to 10 in every step which are defined in this experiment. In the end, the participants' emotions are converted to the emotional curves.

4 Results

As the table shows, the participants' emotions were collected in every step (Table 2). Overall, most participants started with lower emotion and felt better until the put-in-capsule step. The feelings from the first put-in-capsule step to the second take-out-capsule are relatively higher, and all the participants reached the highest emotions in this section apart from the finished step. On the other hand, the turn-on and turn-off steps are two lowest points. In average, the lowest point is turn-on step which gets 4.33 points in average, and the second lowest is turn-off which gets 5.33 points. In addition, the relative lower points are throw-away steps, and the first gets 6 points and the second 5.5 points. The two highest points are happened in the filling hot water which gets 7.67 and 7.5 points.

The last part in the table 2 we discussed the peak-end value and the feeling of satisfaction. The peak-end value is an average of the peak value and end value. Take sample 1 for example, the peak value (except end value) is 9 and the end value is 10, so the average is 9.5. There are little connections between peak-end values and retrospective evaluations except participant 2and 6.

Table 2 The emotional values in every step

No.	Turn on	Place cup	Put in Capsule1	Fill Water1	Take out Capsule1	Throw Away1	Put in Capsule2	Fill Water2	Take out Capsule2	Throw Away2	Turn off	Finished	Peak-end value	Retro.
1	4	5	6	8	9	8	8	9	5	5	4	10	9.5	9
2	5	2	8	9	9	7	7	8	7	6	3	5	7	8
3	5	5	6	9	3	5	5	9	5	5	5	7	8	8
4	6	7	8	5	7	1	6	7	7	4	7	7	7.5	8
5	3	6	6	8	9	9	9	9	8	7	6	5	7	7
6	3	8	9	6	7	6	8	4	6	6	7	10	9.5	7
AVG	4.33	5.50	7.17	7.50	7.33	6.00	7.17	7.67	6.33	5.50	5.33	7.33	8.08	7.83

The chart of the emotional curves describes how the participants feel and why the emotions changed through the whole process (Fig 4). All the thoughts next to the curve lines were collected from each participant. The number on the top of a thought which represents participant's number as the table shows. The seven thoughts above the chart are positive comments, and six below are negative. In the upper part, five out of seven positive comments are connected to the interaction and design in the process. They can be classified to unique operation, visual and audio factors. On the other hand, participants expressed more kinds of thoughts in the lower part. Two users thought that turn-on step is long time to wait (from red light to green light) until the machine prepared. Two users were depressed

about the design of upper cover. In addition, one thought that it is not eco-friendly in throw-away capsule step, one forgot to turn off and the other one felt sad in the end of using process.

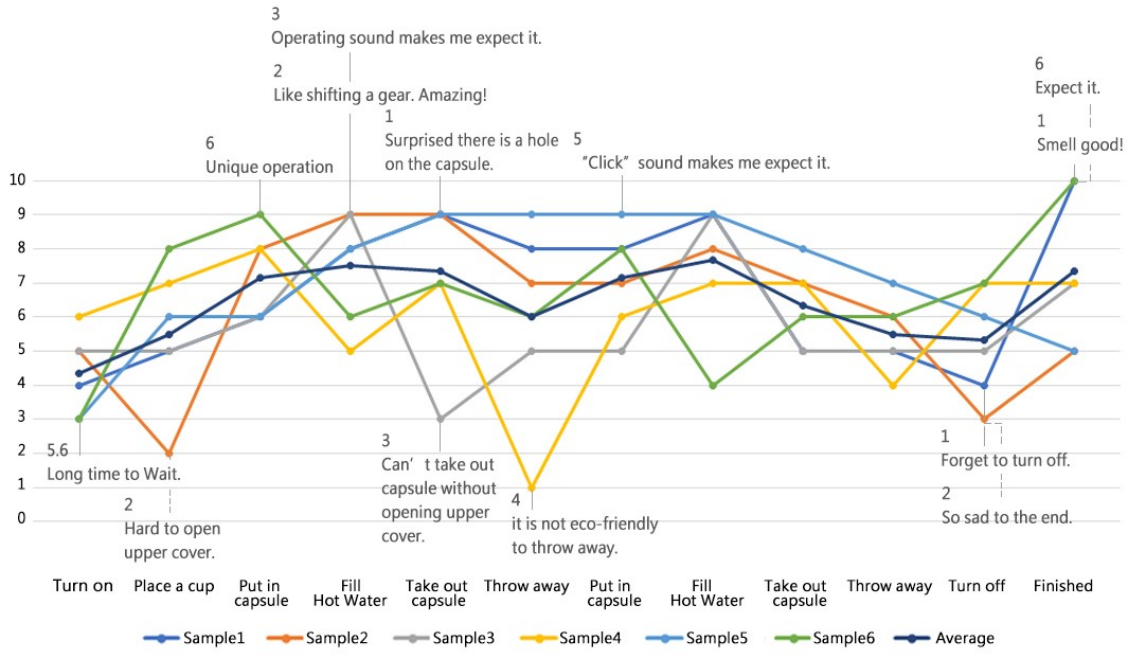

Figure 4. The feelings and emotional curves of six participants

5 Discussion

5.1 Limitations

In this research, only light coffee users were discussed, and the scale of research was small so far. Second, we limited the process of using capsule coffee machine and set every using step in the experiment in order. However, users do not use coffee machines in the same steps in the daily lives. Thus, the results uncovering the participants' emotions in the using process only can represent part of users in real life.

5.2 Discussion

We intended to find a way to measure the emotions and thoughts in the product use process. Although emotional scores were explained and clarified in the beginning of the experiments, tt still showed individual differences in measuring their emotions which influenced the results of the experiments. However, it uncovered some insights that are difficult to recognize by other design methods, such as: user journey map. We build a framework for users to assess their experience and emotions by themselves instead of creating a journey map by designers.

6 Conclusions

This study expected to know if the peak-end rule is feasible in product use process and gained the evidences that the higher the peak-end value of the positive mood in the product use, the higher the pleasure users feel.

The results pointed out some difficulties when applying the peak-end rule to assess users' emotions in product use. Although the correlation between the peak-end values and

retrospective evaluations cannot be verified so far, we still build a theoretical structure to extended research. It provided some insights that were rarely discovered by other design methods. In this research, we built a framework to assess users' experience and emotions based on users' real emotions instead of creating a journey map by designers.

In addition, we also found some insights in using capsule coffee machine. Participants got positive feeling because of unique operation, visual and audio factors. On the other hand, participants expressed more kinds of thoughts when having negative feeling.

In the future, there are few things that need to adjust, including defines of the emotional values and scales of the researches. However, it's a good start to apply thinking aloud protocol and peak-end rule to these experiments. This is a method that directly and efficiently gain insights and emotions from participants. After, more participants will take part in the study to make further study robust and we also discuss more users' sensory experience in the research.

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